DECLARATION

I, Taijiro Ogawa c/o SHIGA INTERNATIONAL PATENT OFFICE, 2-3-1 Yaesu, Chuo-ku, Tokyo 104-8453 Japan, understand both English and Japanese, am the translator of the English document attached, and do hereby declare and state that the attached English document contains an accurate translation of U.S. Provisional Patent Application No. 60/436,794 filed on December 27, 2002, that all statements made herein are true to the best of my knowledge.

Declared in Tokyo, Japan

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[Document Name] Specification

[Title of the invention] Aqueous Shellac Coating Agent, Production Process Therefor, and Coated Food and Coated Drug Using Same

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an aqueous shellac coating agent with excellent enteric properties, acid resistance, masking characteristics, moisture resistance, gloss, and stability, as well as a process for producing such a shellac coating agent, and a coated food and a coated drug covered with such a shellac coating agent.

[0002]

[Prior Art]

Shellac is produced mainly in India, Thailand and the south of China, and is a resin type material obtained from the secretions of Laccifer Lacca insects that live as parasites on shrubs such as beans and mulberries. Shellac is a natural product comprising resin acid esters of aleuritic acid and shellolic acid, or aleuritic acid and jalaric acid as a primary component. Shellac is recorded within Japan's Specifications and Standards for Food Additives, as well as in the Japanese Pharmacopoeia, the United States Pharmacopoeia, and the European Pharmacopoeia. It is recorded under the name "shellac" in Japan's Specifications and Standards for Food Additives, whereas in the Japanese Pharmacopoeia, the product obtained by refining the crude product is recorded under the name "refined shellac", and the product obtained by bleaching is listed under the name "white shellac". Because shellac has film forming properties, it provides an ideal edible coating derived from a natural product offering high levels of safety, and is widely used as a coating for

confectionery, medication tablets, seeds, and fruit and the like, and as a raw material in paints and inks. The coloring of the shellac coating differs depending on the degree of refining. A coating formed from a typical refined shellac is a dark brown color, whereas coatings formed from decolorized shellac or white shellac that have undergone additional decolorization treatment, can be light yellow, or even very faintly yellow, and consequently the color can be selected depending on the intended purpose or application. In the case of foodstuffs or drugs, the external appearance is often extremely important, and so exclusively decolorized shellac or white shellac is used as the coating agent. In most cases, the shellac coating is used in the form of a solution produced by dissolving the shellac in a solvent such as an alcohol like ethanol.

[0003]

Examples of the methods used for coating the shellac onto a foodstuff or a drug include methods in which the target objects to be coated, such as tablets, are immersed in an alcohol solution of shellac, and subsequently dried, thereby forming a coating on the surface of the target objects, and methods in which a shellac solution is sprayed onto the target objects to be coated using either cold air or hot air aeration, thereby forming a coating. A coating formed by one of these methods displays enteric properties, acid resistance, gloss, and moisture resistance, and can be used

-for preventing the deactivation of acid intolerant enzymes and lactic acid bacteria in gastric acid, and for imparting enteric properties,

-for masking the taste of bitter materials such as vitamins, and

-for preventing moisture absorption by sugars, and moisture proofing deliquescent materials.

However, when an alcohol solution of shellac is used in the coating process, a problem arises in that stringiness can develop as a result of increased stickiness during

coating. In the case where the shellac has been coated onto tablets for example, this stringiness can lead to partial separation within the coating film, leading to a vastly inferior external appearance for the coated tablets, and an increased likelihood of rejects. In addition, because large quantities of organic solvent are used in the production methods described above, an additional problem arises in terms of the accumulated costs associated with installing fire extinguishing equipment and the like at the production facility, and initiating measures to ensure the health and safety of staff and prevent environmental pollution.

Furthermore, another characteristic of shellac coatings is that they tend to degenerate over time, and consequently in those cases where a shellac coating agent is used as an enteric coating material, this enteric property is gradually lost over time, meaning the coating becomes insoluble in the intestine, which represents a major drawback.

[0004]

Conventionally, in order to overcome the problems associated with shellac described above, the following types of measures have been proposed.

(1) It has been proposed that the problem of stringiness occurring during coating can be prevented by combining the shellac with a vegetable oil, an animal oil or a wax or the like (for example, see patent reference 1).

(2) Methods that avoid the use of organic solvents in the shellac solution by forming an aqueous solution using an alkali metal hydroxide such as sodium hydroxide or ammonia are well known, and a method for obtaining an oil resistant coating from an aqueous shellac solution produced using ammonia water has been proposed (for example, see patent reference 2).

(3) A method of suppressing the degeneration of the coating over time by combining the shellac with tocopherol has also been proposed (for example, see patent reference 3).

[0005]

(Patent Reference 1)

Japanese Unexamined Patent Application, First Publication No. Hei 8-311405

(Patent Reference 2)

Japanese Unexamined Patent Application, First Publication No. 2002-1864

(Patent Reference 3)

Japanese Unexamined Patent Application, First Publication No. Sho 55-162715

[0006]

[Problems to be solved by the Invention]

However, in the methods (1) and (3) described above, the existing problems associated with organic solvent use remain. Furthermore in the method (2), if ammonia water is used, then not only does the coating liquid develop an unpleasant odor, causing a deterioration in the operating environment, but the coating solution formed has a significant drawback in that it is very prone to color change and degeneration over time. Furthermore, if an aqueous shellac solution produced using sodium hydroxide is used for coating tablets, then even if a shellac that has undergone decolorization treatment is used, the produced coating is either brown or a red-brown color, leading to a potential decrease in the commercial value of coated foodstuffs or drugs. Furthermore during coating, the reduction in workability associated with stringiness is a considerable problem, and this stringiness is particularly marked when white shellac is used. Preventing such problems from arising places a considerable workload on the producers.

In addition, in terms of the enteric properties of coated tablets, it is difficult to achieve a coating that displays resistance to gastric juices and yet disintegrates in

intestinal juices using either the method (1) or the method (3) above, whereas in the method (2), if for example a shellac solution is produced using sodium hydroxide, then penetration by gastric juices while the tablet is still in the stomach can cause considerable swelling of the tablet, inviting leakage of the tablet contents, and in extreme cases the tablet may actually disintegrate while still in the stomach, meaning the desired enteric function is not accomplished.

As described above, a large number of techniques have been investigated as potential solutions to the problems associated with shellac coating agents, but even by combining these different techniques, it has not been possible to resolve the existing problems without generating new problems, and consequently a resolution of the above problems has been keenly sought.

[0007]

The present invention takes the above circumstances into consideration, with an object of providing an aqueous shellac coating agent with excellent enteric properties, acid resistance, masking characteristics, moisture resistance, gloss, and stability, as well as a process for producing such a shellac coating agent, and a coated food and a coated drug covered with such a shellac coating agent.

[0008]

[Means for Solving the Invention]

In order to achieve the above object, the present invention provides an aqueous shellac coating agent characterized by comprising shellac, which contains a basic amino acid and/or a basic phosphate.

In an aqueous shellac coating agent according to the present invention, the basic amino acid described above is preferably one or more materials selected from a group consisting of arginine, lysine, and ornithine.

The aforementioned basic phosphate is preferably one or more materials selected from a group consisting of trisodium phosphate, tripotassium phosphate, disodium hydrogenphosphate, dipotassium hydrogenphosphate, tetrasodium pyrophosphate, and tetrapotassium pyrophosphate.

In an aqueous shellac coating agent of the present invention, the quantity of the basic amino acid is preferably within a range from 0.05 to 0.40 parts by mass per 1 part by mass of shellac.

The quantity of the basic phosphate is preferably within a range from 0.04 to 0.60 parts by mass per 1 part by mass of shellac.

[0009]

Furthermore, the present invention also provides a process for producing an aqueous shellac coating agent, comprising the steps of mixing the shellac and a basic amino acid solution, preparing an aqueous shellac coating liquid with the shellac stably dissolved or dispersed therein, and where necessary, concentrating or drying the coating liquid.

[0010]

In addition, the present invention also provides a process for producing an aqueous shellac coating agent, comprising the steps of dispersing the shellac in a solution of an acidic material, subsequently adding a basic alkali metal salt to the solution, preparing an aqueous shellac coating liquid with the shellac stably dissolved or dispersed therein, and where necessary, concentrating or drying the coating liquid.

In this production process, the basic alkali metal salt is preferably one or more compounds selected from a group consisting of alkali metal hydroxides, carbonates, and bicarbonates.

The acidic material is preferably one or more compounds selected from a group consisting of phosphoric acid and polyphosphoric acid.

[0011]

Furthermore, the present invention also provides a coated food formed by coating a food with an aforementioned aqueous shellac coating agent.

[0012]

In addition, the present invention also provides a coated drug with a multi-layered coating comprising a layer containing an aforementioned aqueous shellac coating agent as a primary component, and a layer containing another coating agent as a primary component.

[0013]

[Embodiments of the Invention]

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As follows is a detailed description of embodiments of the present invention.

As a result of intensive investigations aimed at achieving the object described above, the inventors of the present invention discovered that by adding a basic amino acid, and/or a basic phosphate to shellac, an aqueous shellac coating agent could be obtained that resolved the problems associated with the conventional technology described above, and were hence able to complete the present invention.

In other words, the present invention relates to an aqueous coating agent formed from a composition produced by dissolving, or partially dissolving, shellac, which is insoluble in water under neutral conditions or acidic conditions, in water in the presence of a basic amino acid and/or a basic phosphate, as well as foodstuffs and drugs coated with such a coating agent.

[0014]

In this document, the term "aqueous" means that the shellac coating agent is either dissolved or dispersed in water, that is, the shellac coating agent is either water soluble or water dispersible.

The formation of an aqueous coating agent refers to the acquisition by a shellac that is insoluble in water under neutral conditions or acidic conditions, such as purified shellac, decolorized shellac or white shellac, of the "aqueous" property described above, through the addition of a basic amino acid such as arginine and/or a basic phosphate such as trisodium phosphate to the shellac.

The term "basic phosphate" refers to a phosphate salt that forms an aqueous solution that displays basicity.

The term "coating agent" is not restricted to the coating agents used in fields such as the production of foodstuffs or the production of drugs, but refers to any coating agent (also referred to by other names such as film forming agent) that is used in any of a variety of fields to form a coating on an object or product.

The process of "coating" refers to the application of a coating agent of the present invention to a target object to be coated such as a food or a drug, thereby covering at least a portion of the surface of the target object with the coating agent. Furthermore, the coating need not necessarily be formed as the outermost layer on the target object, and configurations in which the coating film is over-coated, or configurations in which the coated product is encased within a capsule are also possible.

The term "coated" describes an object that has had a coating applied.

The term "food" refers to all foodstuffs that are edible by people or animals.

Furthermore, the term "drug" refers to all types of drugs that can be administered to people or animals.

[0015]

The shellac used in the present invention can be appropriately selected from any of the various known shellacs, and may utilize materials marketed under names such as refined shellac, decolorized shellac, or white shellac. If the coloring of the coating is taken into consideration, then decolorized shellac and white shellac are preferred.

[0016]

In the present invention, an aqueous coating agent is achieved by adding a basic amino acid and/or a basic phosphate to the shellac. There is no necessity for the shellac to dissolve completely, and provided any undissolved shellac exists as fine particles, then the presence of such residual undissolved shellac does not greatly impede the formation of a uniform coating.

[0017]

The basic amino acid added can utilize any known basic amino acid such as arginine, lysine, ornithine, hydroxylysine, and histidine, but is preferably one or more materials selected from a group consisting of arginine, lysine, and ornithine, and from the viewpoint of coating workability, arginine is the most desirable. In contrast, high molecular weight basic amino acid compounds such as polylysine are ineffective in forming an aqueous shellac coating agent, and cannot be used as the sole basic amino acid.

[0018]

The basic phosphate can utilize those basic phosphates that are authorized for use within the production of foodstuffs or drugs, and one or more compounds selected from a group consisting of trisodium phosphate, tripotassium phosphate, disodium hydrogenphosphate, dipotassium hydrogenphosphate, tetrasodium pyrophosphate, and tetrapotassium pyrophosphate are preferred. Generation of an aqueous coating agent using only weakly acidic salts such as sodium dihydrogenphosphate proved difficult.

[0019]

In the present invention, either the basic amino acid or the basic phosphate can be added in isolation to the shellac, or a combination of the compounds can be used, depending on the intended purpose or application. Furthermore, these compounds can also be used in combination with materials other than the basic amino acid and the basic phosphate, for example, basic materials that are authorized for use within the production of foodstuffs or drugs, such as sodium hydroxide, potassium hydroxide, calcium hydroxide, sodium carbonate and potassium carbonate. However, if an attempt is made to form an aqueous coating agent from a decolorized shellac using only one of the basic materials other than the basic amino acid and the basic phosphate, such as sodium hydroxide, then the product coating is either brown or a red-brown color, which is markedly different from the coloring of the coating produced by the original decolorized shellac. Alkali soluble coating agents, such as cellulose derivatives formed from ether linkages like hydroxypropylmethylcellulose phthalate, are known, but the coloring of coatings formed from aqueous solutions of these types of materials did not vary significantly depending on the basic material used to form the aqueous coating agent. This phenomenon, where the coloring of the coating varies considerably depending on the basic material used for formation of the aqueous coating agent was observed only for shellac.

[0020]

The quantities of the basic amino acid and/or the basic phosphate used in formation of producing an aqueous shellac coating agent vary depending on the raw material shellac used, and on the type (for example, the strength of the basicity and the like) of basic amino acid or basic phosphate added, although typically the quantity of the basic amino acid is within a range from 0.05 to 0.40 parts by mass, and preferably from 0.12 to 0.29 parts by mass, per 1 part by mass of the shellac, while the quantity of the

basic phosphate is within a range from 0.04 to 0.60 parts by mass, and preferably from 0.08 to 0.45 parts by mass, per 1 part by mass of the shellac. If the quantities of the basic amino acid and/or the basic phosphate are less than the above ranges, then the conversion of the shellac to an aqueous coating agent is unsatisfactory, and forming a favorable coating is difficult. In contrast, if the quantities of the basic amino acid and/or the basic phosphate exceed the above ranges, then the coloring of the formed coating may darken, the water resistance and acid resistance of the coating may deteriorate, and production costs will increase. The pH of a coating solution comprising a coating agent of the present invention is preferably at least 6.0, and even more preferably within a range from 6.5 to 8.0.

[0021]

An aqueous shellac coating agent of the present invention can be produced by a variety of processes, including a process in which the shellac is dispersed in water, and a basic amino acid and/or a basic phosphate is then added, or a process in which the shellac is added to an aqueous solution containing a basic amino acid and/or a basic phosphate dissolved in water.

In those cases where an aqueous shellac coating agent is produced using a basic amino acid, it is preferable that a solution containing the basic amino acid such as arginine dissolved in water is first prepared, and the shellac is then added to this basic amino acid solution and stirred to form an aqueous shellac coating liquid with the shellac stably dissolved or dispersed therein. This aqueous shellac coating liquid may be either used as is, or if necessary may be concentrated or dried.

[0022]

In another possible production process, the shellac is dispersed in a solution of an acidic material, a basic alkali metal salt is then added to the solution to form an aqueous

shellac coating liquid with the shellac stably dissolved or dispersed therein, and where necessary, this liquid is then concentrated or dried. In this production process, the basic alkali metal salt is preferably one or more compounds selected from a group consisting of alkali metal hydroxides, carbonates, and bicarbonates. The acidic material can utilize organic acids, hydrochloric acid, sulfuric acid, nitric acid, phosphoric acid, or polyphosphoric acid or the like, although one or more compounds selected from a group consisting of phosphoric acid and polyphosphoric acid are preferred.

[0023]

An aqueous shellac coating agent of the present invention can be used for coating food or drug formulations such as tablets, granules or capsules, and enables the production of a coated food or a coated drug according to the present invention, which displays functions such as enteric properties, acid resistance, masking characteristics, moisture resistance, gloss, and stability. Furthermore, in the case of capsules, the coating agent of the present invention may also be added in advance to the encapsulating base material.

Specific examples of actual uses of the coating include adding gloss to sugarcoated tablets, masking the taste of vitamin tablets, and imparting acid resistance to lactic acid bacteria, enzymes, and protein based agents, although the coated foods and coated dugs according to the present invention are not limited to these uses.

In addition, aqueous shellac coating agents of the present invention are not restricted to applications for forming coatings on foodstuffs or drugs, and can also be applied to a wide variety of other applications, including electrical insulation applications (such as insulating materials for transformers, insulating varnish for use in generators or motors, insulating adhesives for use in vacuum tubes and bulbs, and for electronic processing of photoresists and the like), painting applications (such as alcohol based varnish for coating furniture or musical instruments, and water based paints for building

materials), bonding and adhesive applications (release agents for adhesive tapes, process adhesives for gems or glass), printing applications (such as spreading agents for water based inks, and pattern paper impregnants), polishing applications (binders for felt polishing), and other applications (including cosmetic materials such as hair lacquers, moisture-proof agents for fireworks and the like, binders, and packing).

[0024]

The operation of coating a coating agent of the present invention onto a foodstuff or drug uses an aerated type pan coating apparatus or a fluidized bed coating apparatus, although the actual apparatus used is preferably selected in accordance with the formulation to be coated. In the coating operation of a coating agent of the present invention, there are no particular restrictions on the concentration of the shellac within the coating liquid, although typical values are within a range from 1 to 30% by mass, and preferably from 3 to 20% by mass. The shellac coating quantity can be altered depending on the formulation, but for tablets, the quantity is typically within a range from 0.5 to 40% by mass , and preferably from 2 to 25% by mass, whereas in the case of granules, either similar quantities or even higher quantities can be used. Furthermore, when a coating agent of the present invention is used, the target may be undercoated in advance with hydroxypropylmethylcellulose or the like, and furthermore following coating, a surface gloss agent such as wax may be overcoated on top of the coating agent of the present invention.

[0025]

Where necessary, additives such as colorants, plasticizers, masking agents, flavorings, dispersants, high viscosity polysaccharides, antioxidants, and preservatives may also be added to a coating agent of the present invention, and synthetic polymers can also be combined with the coating agent. Furthermore, in order to improve the

dispersibility and prevent breakdown of these additives, a water soluble organic solvent such as ethanol, methanol, acetone, or ispropanol may also be added, although from the viewpoints of safety and environmental impact, the use of such solvents is preferably restricted to the absolute minimum.

[0026]

An aqueous shellac coating agent of the present invention does not use a volatile organic solvent such as alcohol during production or during the liquid coating process, and consequently there is no danger of fire, and the safety of the working environment is excellent, and as a result the costs associated with workplace safety can be reduced.

Furthermore, in cases where decolorized shellac is used as a raw material, and an aqueous coating agent formed in accordance with the present invention is applied to tablets or the like, the external appearance of the coating presents a favorable yellow or light yellow color, and the coating is also stable over time, and unlikely to degenerate.

In addition, a coating produced using such a coating agent displays excellent acid resistance, and is effective as a base material for an enteric coating, and even if the coating is immersed in an artificial gastric acid liquid (the first liquid specified in the Japanese Pharmacopoeia), it was discovered that the swelling of the tablets was suppressed compared with that of aqueous shellac coated tablets generated using sodium hydroxide, indicating an improved level of acid resistance.

[0027]

[Examples]

As follows is a more detailed description of the present invention based on a series of examples, although the present invention is in no way restricted to these examples.

[0028]

(Example 1)

- Preparation of a Coating Liquid

10 parts by mass of decolorized shellac was dispersed in 88.35 parts by mass of distilled water at 55°C, and with the mixture undergoing constant stirring with a stirrer, 1.65 parts by mass of L-arginine was added, and the resulting mixture was stirred thoroughly until no large particles remained within the liquid, thereby completing the preparation of a coating liquid (containing 10% by mass of shellac) for a coating agent of the present invention.

- Preparation of Coated Tablets

350 g of white triangular tablets with a mass of 220 mg per tablet were set in a coating apparatus (brand name "Hicoater lab", manufactured by Freund Industrial Co., Ltd.), and using operating conditions including an air supply temperature of 52°C, an air supply rate of 0.5 m^3/minute, a spray rate of 2 g/minute, a spray pressure of 0.1 MPa, and a pan rotational speed of 20 rpm, the triangular tablets were sprayed with the coating liquid described above until the shellac solid fraction reached a value of 12% by mass of the total tablet mass, thereby yielding coated tablets.

[0029]

(Example 2)

With the exceptions of altering the quantity of distilled water to 88.4 parts by mass, and using 1.6 parts by mass of tetrasodium pyrophosphate instead of the L-arginine, a coating liquid of the present invention was prepared in the same manner as the example 1. The same coating operation as the example 1 was then conducted, yielding coated tablets in which the shellac solid fraction was 12% by mass of the total tablet mass.

[0030]

(Example 3: Preparation of Taste Masking Granules)

500 g of granules containing 5.5% by mass of a bitter tasting thiamine hydrochloride (granule diameter 12 to 32 mesh) were set in a fluidized bed granule coating apparatus (brand name "Flow Coater lab", manufactured by Freund Industrial Co., Ltd.), and using the same coating liquid as the example 1, and under conditions including an air supply temperature of 70°C, an air supply rate of 0.5 m^3/minute, a spray rate of 3 g/minute, and a spray pressure of 0.15 MPa, coated granules were obtained in which the shellac solid fraction was 7% by mass of the total granule mass.

[0031]

(Example 4: Moisture Permeability Test)

The coating liquid prepared in the example 1 was dried on top of a flat Schale formed from a resin (at a temperature of 50°C), yielding a casting film of thickness 90 μm. The moisture permeability of this film obtained from the coating liquid of the example 1 was then measured in accordance with the test method specified in the Japan Industrial Standards (JIS Z0208).

[0032]

(Comparative Example 1)

With the exceptions of altering the quantity of distilled water to 89.4 parts by mass, and using 0.6 parts by mass of sodium hydroxide instead of the L-arginine, a coating liquid was prepared in the same manner as the example 1. The same coating operation as the example 1 was then conducted, yielding coated tablets in which the shellac solid fraction was 12% by mass of the total tablet mass.

[0033]

(Comparative Example 2)

10 parts by mass of decolorized shellac and 2.5 parts by mass of vegetable oil (hardened palm oil) were added to 85.2 parts by mass of ethanol, and 2.3 parts by mass of

the monoglycerin ester of was then added, and the resulting mixture was stirred until a transparent solution was obtained, thereby completing the preparation of a coating solution. Using the same apparatus as the example 1, coating was conducted under operating conditions including an air supply temperature of 38°C, an air supply rate of 0.5 m^3/minute, a spray rate of 2 g/minute, a spray pressure of 0.1 MPa, and a pan rotational speed of 20 rpm, yielding coated tablets in which the shellac solid fraction was 12% by mass of the total tablet mass.

[0034]

(Comparative Example 3)

With the exception of altering the shellac solid fraction coated onto the tablets to a value of 6% by mass relative to the tablet mass, coated tablets were prepared using the same operation as the comparative example 2.

[0035]

(Comparative Example 4)

With the exception of using an 8% by mass aqueous solution of hydroxypropylmethylcellulose as the coating liquid, a casting film of thickness 90 μm was prepared, and the moisture permeability was measured, in the same manner as the example 4.

[0036]

(Comparison of Coating Characteristics)

For the above examples 1 and 2, and the comparative examples 1 to 3, the methods described below were used to evaluate the coating workability, the coloring of the coating on the coated tablets, the acid resistance, the disintegration in intestinal juices, and the stability. The results are shown in Table 1.

[0037]

(Coating Workability)

In each coating operation, the tablets were inspected for the presence of adhesion of the tablets to the coating pan due to stringiness of the coating liquid, and peeling of the coating at the coated surface, and were then evaluated using the following criteria.

O: No coating faults. Coated tablets with a uniform coating were obtained.

Δ: Some coating faults. The surface coating had peeled away in some tablets.

×: Coating faults: Tablets adhered to the coating pan, and the surface coating had peeled away in most tablets.

[0038]

(Coloring of the Coating)

The external coloring of each of the coated tablets was inspected visually. The color of the surface coating on the tablets was recorded.

[0039]

(Disintegration Tests: Determination of Gastric Juice Resistance and Intestinal Juice Disintegration)

Each of the coated tablets was evaluated in accordance with the test method for enteric formulations, one of the disintegration test methods detailed in the Japanese Pharmacopoeia. The first liquid used as a test liquid corresponds with artificial gastric juice, and was used to evaluate the acid resistance of the coating, whereas the second liquid corresponds with artificial intestinal juice, and was used to evaluate the disintegration of the coating within the intestine.

During the tests using the first liquid, the dissolution or disintegration of the coating was determined by viewing the permeation of the first liquid into the coated tablets, and was evaluated using the following criteria.

O: Two hours after commencing the disintegration test, there are no marked changes in the coated tablets.

×: Two hours after commencing the disintegration test, swelling and/or disintegration of the coated tablets resulting from permeation of the first liquid is marked.

Furthermore, in the tests using the second liquid, the time required to reach the standard for intestinal disintegration was measured.

[0040]

(Stability Test)

Each of the coated tablets was packaged in PTP and stored for 3 months in an atmosphere at 40°C, and the above disintegration tests were then repeated to evaluate the stability. The evaluation method was the same as that described above for the disintegration tests.

[0041]

Table 1

		Example 1	Example 2	Comparative Example 1	Comparative Example 2	Comparative Example 3
Coating workability		O	O	× adhesion to pan, peeling of coating	Δ adhesion to pan, peeling of coating	Δ adhesion to pan, peeling of coating
Coating coloring		cream	light cream	light brown	cream	light cream
Disintegration tests	First liquid (gastric acid resistance)	O	O	× marked swelling or disintegration	O	× marked swelling or disintegration
	Second liquid (intestinal juice disintegration)	within 10 minutes	within 10 minutes	within 10 minutes	did not disintegrate	50 minutes
Stability Test	First liquid (gastric acid resistance)	O	O	× marked swelling or disintegration	O	× marked swelling or disintegration
	Second liquid (intestinal juice disintegration)	within 10 minutes	within 10 minutes	within 10 minutes	did not disintegrate	did not disintegrate

[0042]

From the results shown in Table 1, it is clear that the examples 1 and 2, which utilize aqueous shellac coating agents of the present invention, display excellent coating workability and provide a high product yield with few defects, when compared with both the comparative example 1, which represents a conventional aqueous coating agent prepared using sodium hydroxide, and the comparative examples 2 and 3, which utilize coating agents in which the shellac is dissolved in an organic solvent (ethanol).

Furthermore, the colorings of the coatings from the examples 1 and 2 are lighter than that of the comparative example 1, and provide a favorable external appearance.

In addition, the coatings of the examples 1 and 2 display sufficiently favorable levels of gastric acid resistance and enteric disintegration to enable their practical application within enteric coatings.

[0043]

(Comparison of Masking Performance of Coatings)

The coated granules produced in the example 3, and uncoated granules were evaluated for taste masking effect using the method described below. The results are shown in Table 2.

(Evaluation of Taste Masking Effect)

Using the coated granules produced in the example 3 and uncoated granules, taste masking was evaluated using a sensory test. 0.2 g of granules were placed on the tongue, the time taken to notice a bitter taste was measured for five panelists, and the average of the five times was calculated.

[0044]

Table 2

	Example 3	Uncoated granules
Time taken to notice bitter taste	47.5 seconds	2.5 seconds

[0045]

From the results shown in Table 2 it is clear that the coated granules of the example 3 of the present invention display a much longer time for the bitter taste to be noticed than the uncoated granules, indicating that the coating agent of the present invention has a satisfactory taste masking effect.

[0046]

(Comparison of Moisture Resistance of Coatings)

Using the casting films prepared in the example 4 and the comparative example 4, the moisture permeability was measured in accordance with the moisture permeability test of JIS Z0280. The test conditions used were (1) 25°C, relative humidity 92%, and (2)

40°C, relative humidity 89%, enabling the moisture permeability (units: $g/m^2 \cdot 24hr$) of each film to be evaluated. The results are shown in Table 3.

[0047]

Table 3

	Example 4	Comparative Example 4
25°C, relative humidity 92%	155	818
40°C, relative humidity 89%	436	1361

Units: $g/m^2 \cdot 24hr$

[0048]

From the results shown in Table 3 it is clear that the coating of the example 4 according to the present invention displays superior moisture resistance to the coating of the comparative example 4 formed from hydroxypropylmethylcellulose.

[0049]

(Investigation of the Required Quantity of Basic Amino Acid and/or Basic Phosphate)

Using arginine as the basic amino acid and tetrasodium pyrophosphate as the basic phosphate, the quantity of each of these materials required to form an aqueous coating agent with each of the various types of shellac was investigated.

Using decolorized shellac (acid value 73.4) and white shellac (acid value 84.0) as the shellac samples, the quantity of base required to form an aqueous solution of 1 part by mass of the shellac in 1 part by mass of demineralized water at a temperature of 55°C was determined.

In the case of arginine, 0.15 to 0.17 parts by mass were required to generate an aqueous solution with 1 part by mass of decolorized shellac, whereas with white shellac this quantity increased to 0.21 to 0.25 parts by mass.

Furthermore in the case of tetrasodium pyrophosphate, 0.14 to 0.18 parts by mass were required to generate an aqueous solution with 1 part by mass of decolorized shellac, whereas with white shellac this quantity increased to 0.20 to 0.26 parts by mass.

[0050]

As shown above, the quantity of base required to form an aqueous solution of the shellac was different for the decolorized shellac and the white shellac. This difference is caused by the different shellac production methods, and is due mainly to the different acid values generated as a result of the production method. Because shellac is a natural product, the standards relating to acid value recorded in Japan's Specifications and Standards for Food Additives and the Japanese Pharmacopoeia are comparatively broad. The reason for this broadness is to allow for variations in quality of the raw material, and consequently there is a possibility that the predetermined quantities of base determined in the above tests will be either excessive or insufficient (particularly, insufficient). Accordingly, the above required quantity ranges for the basic amino acid (arginine) and the basic phosphate (tetrasodium pyrophosphate) were corrected to ensure that the standard ranges for the shellac acid value could be covered.

According to these corrected ranges, in the case of arginine, 0.12 to 0.19 parts by mass are required to generate an aqueous solution with 1 part by mass of decolorized shellac, whereas with white shellac the range is from 0.16 to 0.29 parts by mass. In the case of tetrasodium pyrophosphate, 0.12 to 0.22 parts by mass are required to generate an aqueous solution with 1 part by mass of decolorized shellac, whereas with white shellac the range is from 0.18 to 0.28 parts by mass.

[0051]

These addition quantities of basic amino acid and basic phosphate refer to the addition quantities for arginine and tetrasodium pyrophosphate relative to refined

decolorized shellac or white shellac, and if a basic amino acid other than arginine, or a basic phosphate other than tetrasodium pyrophosphate is used, then the ideal addition quantity will vary. Furthermore, aqueous shellac coating agents of the present invention include not only solutions in which the shellac is completely dissolved, but also shellac dispersions in which a portion of the shellac is dissolved and the remainder is dispersed in the form of undissolved fine particles. When this type of dispersion coating liquid is prepared, the quantity added of the basic amino acid and/or the basic phosphate may be lower than the lower limit of the above quantity ranges. Taking these cases into consideration, the quantity of the basic amino acid added can be within a range from 0.05 to 0.40 parts by mass per 1 part by mass of the shellac, and the quantity of the basic phosphate added can be within a range from 0.04 to 0.60 parts by mass per 1 part by mass of the shellac.

[0052]

[Effect of the Invention]

As described above, the present invention enables the provision of an aqueous shellac coating agent that displays superior handling, quality and stability, as well as coated foods and coated drugs covered with such a coating agent, and is industrially very useful.